Office Action Summary	Application No.	Applicant(s)	
	10/643,895	TOCHIO ET AL.	
	Examiner	Art Unit	
	Nathan Curs	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 April 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3, 8-14 and 17-22* is/are rejected.

7)☒ Claim(s) *4-7,15 and 16* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Allowability Withdrawn

1. The indicated allowability of claim 11 is withdrawn in view of the newly cited Berhane reference as described below. Rejections based on the newly cited reference(s) follow.

Claim Objections

2. Claims 1, 3, 5, 6, 7, 11, 16, 17, 19, 21 and 22 are objected to because of the following informalities:

Claim 1, in line 2 establishes two mirror arrays, each having a plurality of tilt mirrors, and in line 6, recites "at least one of the reflecting surfaces". Based on the claimed relationship of each tilt mirror having a reflecting surface in line 3, there is thus one tilt mirror corresponding to this claimed "at least one of the reflecting surfaces". Claims 21 and 22 recites similar limitations. However, elsewhere in claim 1 and its depending claims and claims 21 and 22, there are various instances of the claim language "each said tilt mirror", "said tilt mirror", "the tilt mirror being an object to be controlled", "the reflecting surface of said tilt mirror", "all tilt mirrors", "the object to be controlled", "said each tilt mirror", "the mirrors" as so on. These recitations are a mixture of referring back to some previous mentioned single tilt mirror and/or referring back to part of or all previously mentioned tilt mirrors. This creates a lot of confusion as to which tilt mirror or collection of tilt mirrors is being referred to.

Claim 3, in lines 6-7, recites "a digital control" signal. Is this supposed to be the same control signal recited as "a control signal" in line 15 of claim 2, or is it a different one?

Claim 3, in line 12, recites "a digital filter". Is this supposed to mean that one of the "band-elimination filter" already recited in claim 2 for the resonance component removing section is a digital filter, or is this digital filter an additional filter?

Claim 3, in line 3 recites "an even digital value as a control signal" and in line 5 recites "an odd digital value as a control signal". Are these two control signals supposed to be in place of, or in addition to, the "a control signal" already recited for the comparison control section in claim 2, and/or the "a digital control signal" recited for the comparison control section in claim 3?

Claim 5, in line 3 recites "0 to 2^n-1 of n-bit digital values as a control signal" and in line 5 recites "2^n-1 to 2^n of the n-bit digital values as a control signal". Are these two control signals supposed to be in place of, or in addition to, the "a control signal" already recited for the comparison control section in claim 2, and/or the "a digital control signal" recited for the comparison control section in claim 3?

Claim 5, in line 8, and claim 6, in line 9, recites "the digital value". This should be "a digital value" because the "a digital value" in claim 4 does not establish antecedent basis for claim 5 or 6, since claims 5 and 6 depend from claim 3.

Claim 6, in line 3 recites "0 to 2^n-1 of n-bit digital values as a control signal" and in line 5 recites "2^n-1 to 2^n of the n-bit digital values as a control signal". Are these two control signals supposed to be in place of, or in addition to, the "a control signal" already recited for the comparison control section in claim 2, and/or the "a digital control signal" recited for the comparison control section in claim 3?

Claim 6, in line 9, recites "a control signal". Of the many control signals recited up to this point, is this one of those, or a new one?

Claim 7 is objected to for the reasons as claims 3 and 6 above.

Claim 11, in line 4, recites "the same characteristic"; this should be "a same characteristic".

Claim 16, in lines 5 and 7 recites two separates instances of "a control signal". Is this the same or different from the "a control signal" recited in claim 2 for the comparison control section?

Claim 17, in line 6, "to be" should be removed.

Claim 19, in line 4, "can be" should be changed to "is" and in line 5, "to be" should be removed.

Claim 21, in lines 10-11, recites "at least commonly corresponding to a pair". It's unclear what "commonly corresponding" means as opposed to just "corresponding".

Claim 22, in line 2, recites "a plurality of mirrors"; this should be "a plurality of tilt mirrors" to be consistent with the rest of the claim. In line 3, the claim recites "and first and second mirror arrays"; this should be "and the first and second mirror arrays" if it's referring to the ones already recited in lines 1-2. In lines 4 and 5, the claim recites, "an input optical signal" followed by "an optical signal"; are these supposed to be the same signal or not? In lines 6-7, the claim recites "providing a feedback control signal to a pair of driving electrodes that change the tilt of the mirrors"; this appears to be claiming a single pair of driving electrodes changing the tilt of all the mirrors at once, however this idea is not supported by the specification.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 17-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 17 recites the limitations "said shared configuration" in lines 4-5 and "the driving electrode" in line 6. There is insufficient antecedent basis for these limitations in the claim.

Claim 18 recites the limitations "the time of initial startup" and "the time of feedback control" in line 4. There is insufficient antecedent basis for these limitations in the claim.

Claim 19 recites the limitations "said shared configuration" in line 4 and "the driving electrode" in lines 5-6. There is insufficient antecedent basis for these limitations in the claim.

Claim 20 recites the limitations "the time of initial startup" and "the time of feedback control" in lines 4-5. There is insufficient antecedent basis for these limitations in the claim.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-3, 8-14, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tochio et al. ("Tochio") (US Patent Application Publication No. 2002/0109076) in view of Berhane et al. ("Berhane") (US Patent Application Publication No. 2002/0171902).

Regarding claim 1, Tochio discloses a control apparatus of an optical signal exchanger which includes a first mirror array and a second mirror array, each having a plurality of tilt mirrors arranged on a plane, each tilt mirror having a reflecting surface an angle of which is controllable, and which sequentially reflects an input optical signal by said first and second

mirror arrays to output from a specific position (fig. 18 and paragraphs 0135-0137), for detecting power of an optical signal output from said specific position, and feedback controlling the angle of at least one of the reflecting surfaces of the tilt mirrors, which have reflected the optical signal on said first and second mirror arrays, based on the detection result (fig. 19 and paragraphs 0138-148). Tochio's systems is based on MEMS, and Tochio discloses a control signal used for feedback control, and a pair of driving electrodes arranged in a coaxial direction of said tilt mirror (fig. 18), but does not disclose that said control apparatus comprises a resonance component removing section that removes a frequency component corresponding to a mechanical resonance action of each said tilt mirror, included in the control signal used for said feedback control, and said resonance component removing section is at least shared corresponding to the pair of driving electrodes. Berhane discloses filtering a control signal for MEMS devices to suppress the mechanical resonance of the MEMS device (paragraphs 0002-0008, 0017, 0018 and 0035-0039). It would have been obvious to one of ordinary skill in the art at the time of the invention to apply the filter teaching of Berhane to the mirror driving circuits of Tochio, to provide the advantage of suppressing mechanical resonsance of the MEMS devices, as suggested by Berhane.

Regarding claim 2, the combination of Tochio and Berhane discloses a control apparatus of an optical signal exchanger according to claim 1, comprising: a first mirror drive section that supplies a voltage to either one of a pair of driving electrodes arranged in a first axial direction of each tilt mirror of said first mirror array (Tochio: fig. 18, element 14a, "X AXIS"), and also supplies a voltage to either one of a pair of driving electrodes arranged in a second direction different from said first axial direction (Tochio: fig. 18, element 14a, "Y AXIS"), to adjust the angle of the reflecting surface of said tilt mirror; a second mirror drive section that supplies a voltage to either one of a pair of driving electrodes arranged in a first axial direction for each tilt

mirror of said second mirror array (Tochio: fig. 18, element 14b, "X AXIS"), and also supplies a voltage to either one of a pair of driving electrodes arranged in a second direction different from said first axial direction (Tochio: fig. 18, element 14b, "Y AXIS"), to adjust the angle of the reflecting surface of said tilt mirror; an optical power detection section that detects power of the optical signal output from said specific position (Tochio: fig. 18, element 12); and a comparison control section that generates a control signal for controlling a driving state of the tilt mirror being an object to be controlled (Tochio: fig. 18, element 13), so that an angular displacement of the reflecting surface of said tilt mirror is corrected according to the optical power detected by said optical power detection section (Tochio: paragraphs 0135-0137), wherein said resonance component removing section includes: a first resonance component removing section that removes said resonance frequency component included in the control signal sent from said comparison control section to said first mirror drive section, by using a band-elimination filter that is at least shared for each of the first axial direction and the second axial direction of said each tilt mirror and a second resonance component removing section that removes said resonance frequency component included in the control signal sent from said comparison control section to said second mirror drive section, by using a band-elimination filter that is at least shared for each of the first axial direction and the second axial direction of said each tilt mirror (Tochio: fig. 19 and Berhane: paragraphs 0006 and 0035-0039, as applicable in the combination, where the resonance eliminating effect of the Berhane-type filter makes it effectively a notch filter or band-elimination filter).

Regarding claim 3, the combination of Tochio and Berhance discloses a control apparatus of an optical signal exchanger according to claim 2, wherein said optical power detection section outputs an analog signal indicating the detected optical power to said comparison control section (Tochio: fig. 19, element 12), said comparison control section

converts the analog signal from said optical power detection section into a digital signal, and then, according to said digital signal, outputs a digital control signal for controlling the driving state of the tilt mirror being the object to be controlled (Tochio: fig. 19, element 13), to said first and second resonance component removing sections, so that the angular displacement of the reflecting surface of said tilt mirror is corrected, and each of said first and second resonance component removing sections removes said resonance frequency component included in the control signal from said comparison control section by using a digital filter (Berhane: paragraph 0006, as applicable in the combination).

Regarding claim 8, the combination of Tochio and Berhane discloses a control apparatus of an optical signal exchanger according to claim 2, wherein said first resonance component removing section removes said resonance frequency component included in the control signal sent from said comparison control section to said first mirror drive section, and said second resonance component removing section removes said resonance frequency component included in the control signal sent from said comparison control section to said second mirror drive section. The combination as applied to claim 2 does not disclose that said first resonance removing section uses a band-elimination filter that is shared corresponding to all tilt mirrors on said first mirror array or that said second resonance removing section uses a band-elimination filter that is shared corresponding to all tilt mirrors on said second mirror array. However, Tochio discloses an array of MEMS mirrors (paragraphs 0136), which suggests that the array is made of up multiple of the same type of mirror and Berhane discloses that the purpose of the filter is to remove a resonance corresponding to the mechanical device (paragraph 0006). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that the filter could be shared for the control signals for all the mirrors, since the resonance is a characteristic of the mechanical MEMS mirror device and since the

resonance for each mirror in an array of alike MEMS mirrors will be essentially the same as the others.

Regarding claim 9, the combination of Tochio and Berhane discloses a control apparatus of an optical signal exchanger according to claim 1, wherein said resonance component removing section is shared corresponding to a pair of driving electrodes arranged in a first axial direction, for all tilt mirrors on said first and second mirror arrays, and also is shared corresponding to a pair of driving electrodes arranged in a second axial direction different from said first axial direction (Tochio: fig. 19 and Berhane: paragraphs 0006, and 0035-0039, as applicable in the combination).

Regarding claim 10, the combination of Tochio and Berhane discloses a control apparatus of an optical signal exchanger according to claim 1, wherein said resonance component removing section comprises, for each of said shared configurations, a band-elimination filter having elimination bandwidth corresponding to a variation in the resonance frequency of said tilt mirror (Berhane: paragraphs 0006 and 0035-0039, as applicable in the combination, where the resonance eliminating effect of the Berhane-type filter makes it effectively a notch filter or band-elimination filter).

Regarding claim 11, the combination of Tochio and Berhane discloses a control apparatus of an optical signal exchanger according to claim 10, wherein said resonance component remove section comprises a circuit in which a plurality of band-elimination filters having the same characteristic are serially connected (Berhane: paragraphs 0035-0039, as applicable in the combination).

Regarding claims 12, 13 and 14, the combination of Tochio and Berhane discloses a control apparatus of an optical signal exchanger according to claim 1, wherein said resonance component removing section removes the resonance frequency component included in said

control signal, and discloses using a band-elimination filter (Berhane: paragraphs 0006 and 0035-0039, as applicable in the combination, where the resonance eliminating effect of the Berhane-type filter makes it effectively a notch filter or band-elimination filter), but does not specifically disclose using a band-elimination filter of Butterworth, Chebyshev or elliptic type. The office takes official notice that Butterworth, Chebyshev or elliptic based filter designs are well known in the art for achieving notch filters. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use Butterworth, Chebyshev or elliptic based filter designs as an engineering design choice in implementing the notch filter already disclosed by Berhane. The type of filter design claimed merely amounts to the selection of expedients known as design choices to one of ordinary skill in the art.

Regarding claim 21, Tochio discloses a control method of an optical signal exchanger which includes a first mirror array and a second mirror array, each having a plurality of tilt mirrors arranged on a plane, each tilt mirror having a reflecting surface an angle of which is controllable, and which sequentially reflects an input optical signal by said first and second mirror arrays to output from a specific position (fig. 18 and paragraphs 0135-0137), for detecting power of an optical signal output from said specific position, and feedback controlling the angle of at least one of the reflecting surfaces of the tilt mirrors, which have reflected the optical signal on said first and second mirror arrays, based on the detection result (fig. 19 and paragraphs 0138-148). Tochio's method is based on MEMS, but Tochio does not disclose that a frequency component corresponding to a mechanical resonance action of each said tilt mirror, included in a control signal used for said feedback control, is removed at least commonly corresponding to a pair of driving electrodes arranged in a coaxial direction of said tilt mirror. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teaching of Berhane with Tochio as described above for claim 1.

Regarding claim 22, Tochio discloses a control apparatus of an optical signal exchanger which includes a first mirror array and a second mirror array, each having a plurality of mirrors arranged on a plane, each tilt mirror having a reflecting surface at an angle, and first and second mirror arrays sequentially reflecting an input optical signal output from a specific position (fig. 18 and paragraphs 0135-0137), to detect power of an optical signal, and the angle of at least one of the reflecting surfaces of the tilt mirrors being feedback controlled based on a detection result, by providing a feedback control signal to a pair of driving electrodes that change the tilt of the mirrors (fig. 19 and paragraphs 0138-148). Tochio does not disclose that the control apparatus comprises a resonance component removing section that removes a frequency component corresponding to a mechanical resonance from the control signal used for said feedback control, provided to the pair of driving electrodes arranged in a coaxial direction of said tilt mirror. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teaching of Berhane with Tochio as described above for claim 1.

Allowable Subject Matter

7. Claims 4-7, 15 and 16 are objected for depending from an objected to claim and being objected to, as described above, but would be allowable if the corresponding objections were overcome and if rewritten to include all the limitations of the base claim and any intervening claims.

8. Claims 17-20 would be allowable if rewritten to overcome the corresponding claim objections and the rejections under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- US Patent Application Publication No. 2005/0002602 – discloses a tilt mirrors based photonic switch where notch filtering is used to remove the fundamental mirror resonance frequency (see paragraph 0078).

10. Any inquiry concerning this communication from the examiner should be directed to N. Curs whose telephone number is (571) 272-3028. The examiner can normally be reached on M-F (from 9 AM to 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan, can be reached at (571) 272-3022. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (800) 786-9199.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pairdirect.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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